



Armed Forces College of Medicine AFCM



Anterior pituitary and prolactin hormone

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INTENDED LEARNING OBJECTIVES (ILOs)



By the end of this lecture the student will be able to:

- ✓ List the anterior pituitary tropic and non-tropic hormones.
- ✓ Correlate the hypothalamic secretion to the anterior pituitary gland functions and secretions.
- ✓ Describe the feedback control of endocrine secretion.
- ✓ Describe the main effects of anterior pituitary

Lecture Plan



Part 1: Introduction to anterior pituitary gland

Part 2: Main Lecture topics

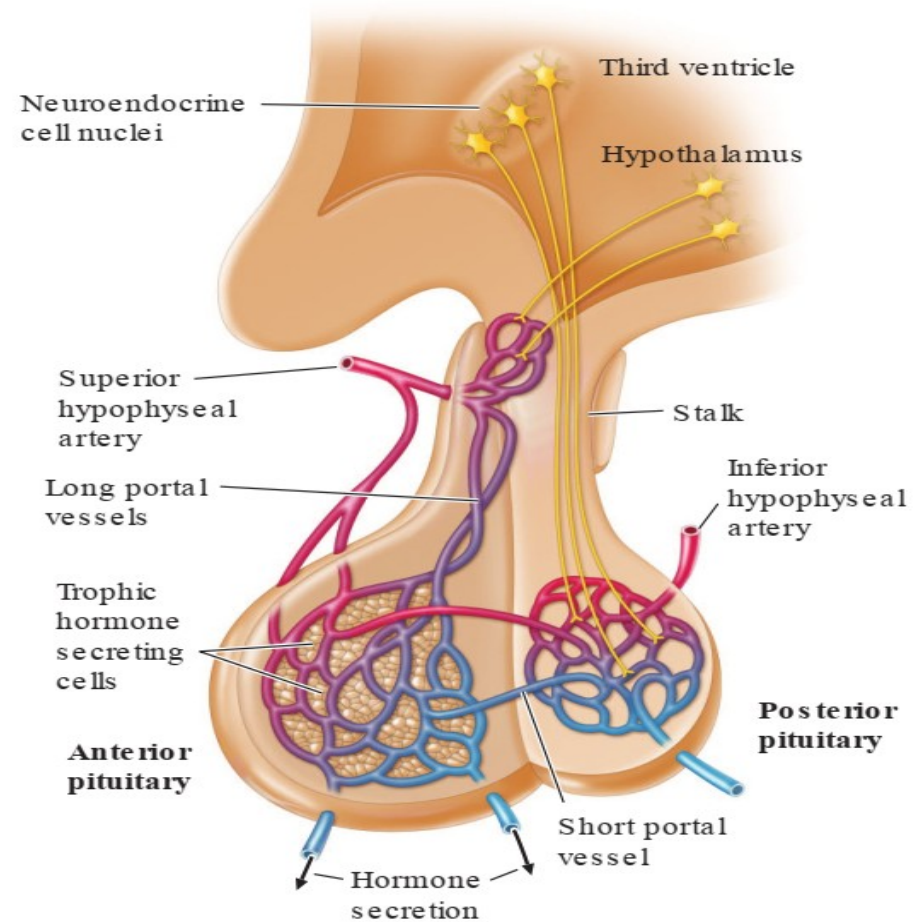
- o Control of anterior pituitary gland secretion
- o anterior pituitary gland hormones

Part 3: Summery

Lecture Quiz



Pituitary gland



**HARRISON'S ENDOCRINOLOGY, 4th
Edition, 2017**

Anterior pituitary gland

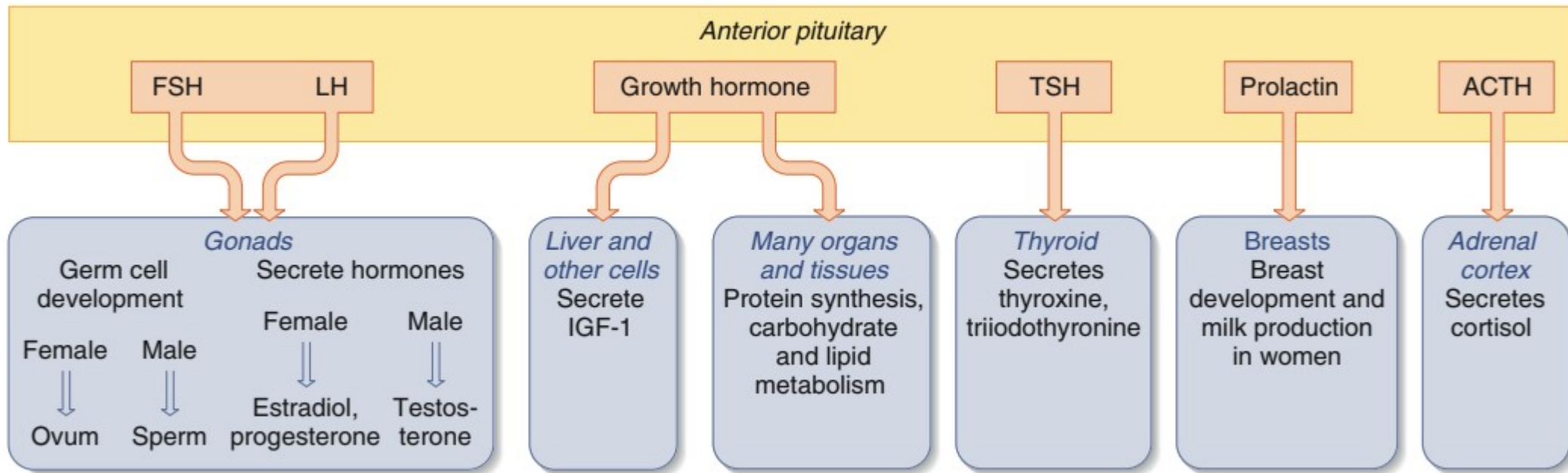


Some glands are **NOT** under control of anterior pituitary e.g. **Parathyroid gland**



https://www.researchgate.net/figure/An-animation-illustrating-how-the-pituitary-gland-orchestrates-the-functions-of-other_fig4_6165172

Anterior pituitary gland hormones



VANDER'S HUMAN PHYSIOLOGY: THE
MECHANISMS OF BODY FUNCTION,
FOURTEENTH EDITION , 2016

Anterior pituitary gland hormones



Tropic Hormones

(regulate
secretion of
another specific
endocrine gland)

- Adrenocorticotrophic hormone (ACTH)
- Thyroid-stimulating hormone (TSH)
- Follicle-stimulating hormone (FSH)

Non tropic Hormones

(does not
stimulate
secretion of
another hormone)

- Luteinizing hormone (LH)
- Growth hormone (GH)
- Prolactin (PRL)

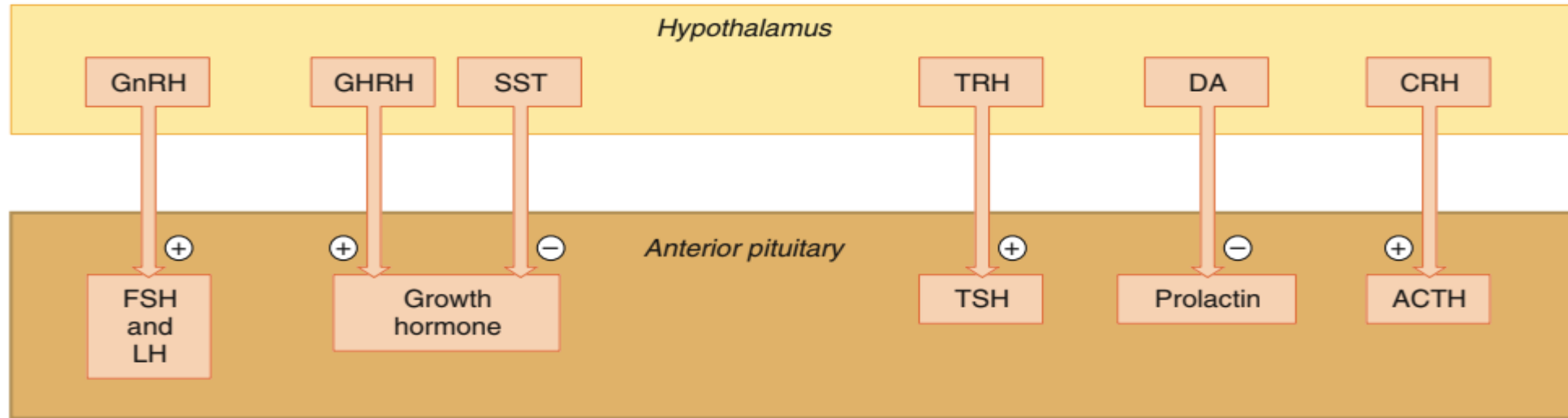
Control of anterior pituitary secretion



Hypothalamic control

Feedback control

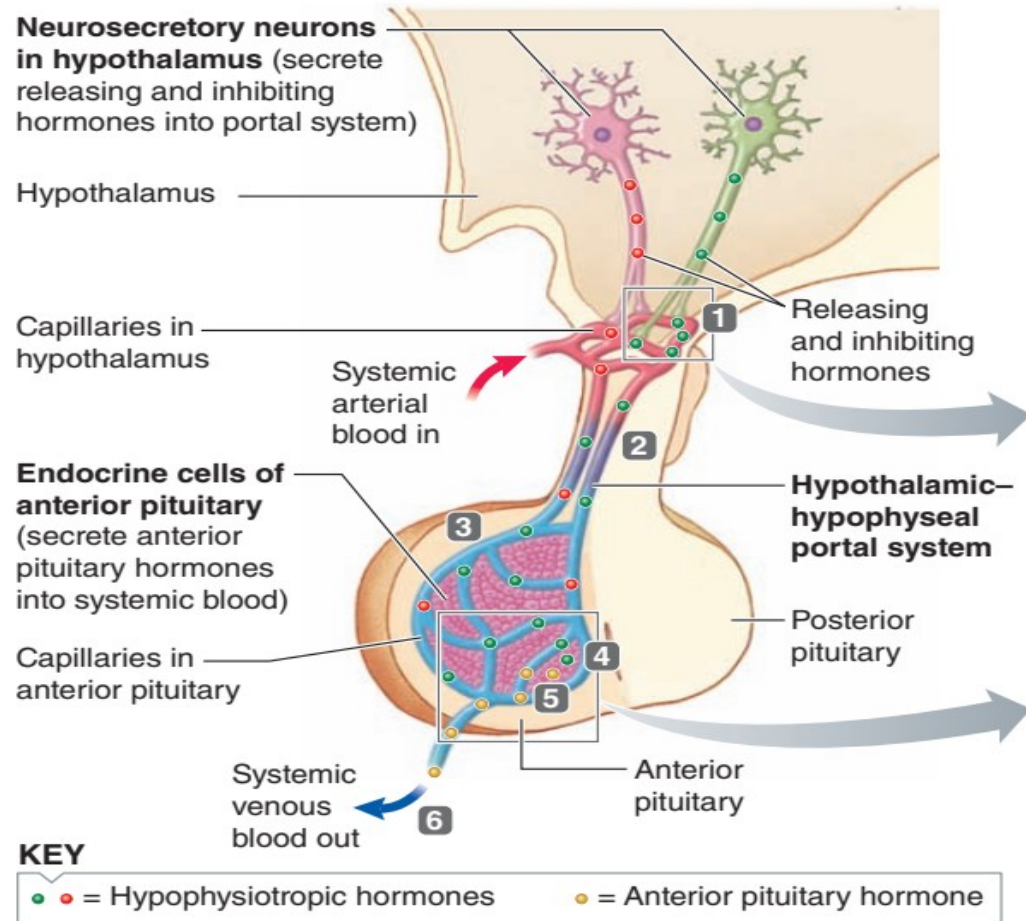
1- Hypothalamic control of anterior pituitary secretion



Major known hypophysiotropic hormones	Major effect on anterior pituitary
Corticotropin-releasing hormone (CRH)	Stimulates secretion of ACTH
Thyrotropin-releasing hormone (TRH)	Stimulates secretion of TSH
Growth hormone-releasing hormone (GHRH)	Stimulates secretion of GH
Somatostatin (SST)	Inhibits secretion of GH
Gonadotropin-releasing hormone (GnRH)	Stimulates secretion of LH and FSH
Dopamine (DA)*	Inhibits secretion of prolactin

VANDER'S HUMAN PHYSIOLOGY: THE
MECHANISMS OF BODY FUNCTION,
FOURTEENTH EDITION , 2016

Hypothalamic hypophyseal-portal circulation



1 Hypophysiotropic hormones (releasing hormones and inhibiting hormones) produced by neurosecretory neurons in the hypothalamus enter the hypothalamic capillaries.

2 These hypothalamic capillaries rejoin to form the hypothalamic-hypophyseal portal system, a vascular link to the anterior pituitary.

3 The portal system branches into the capillaries of the anterior pituitary.

4 The hypophysiotropic hormones, which leave the blood across the anterior pituitary capillaries, control the release of anterior pituitary hormones.

5 When stimulated by the appropriate hypothalamic releasing hormone, the anterior pituitary secretes a given hormone into these capillaries.

6 The anterior pituitary capillaries rejoin to form a vein, through which the anterior pituitary hormones leave for ultimate distribution throughout the body by the systemic circulation.

Lauralee Sherwood, Human Physiology, From Cells to Systems, 2016

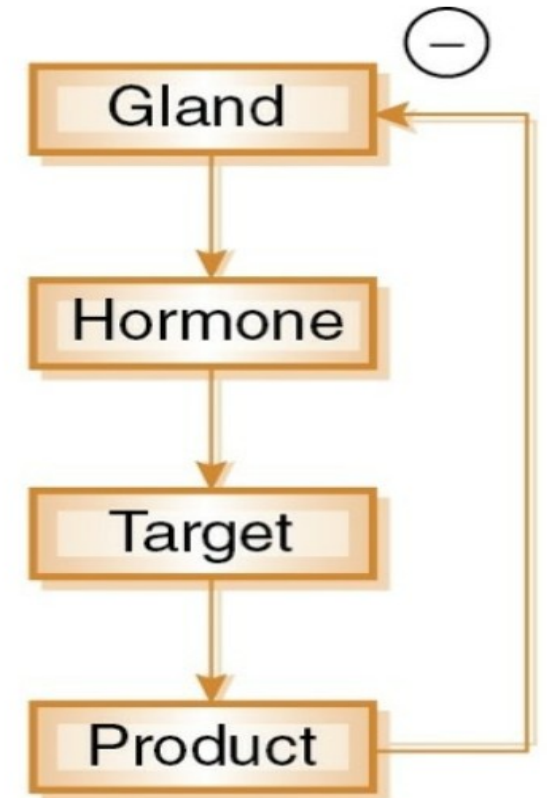
Importance: ensuring reliable transmission of hypothalamic peptide pulses without significant systemic dilution.

2- Feedback control of anterior pituitary secretion



Negative feedback control

- Negative feedback exists when the **output** of a system **counteracts** a change in **input**, maintaining a controlled variable within a narrow range around a desired level, or set point
- Negative feedback ensures that once hormone secretion has been “turned on”, it will not continue unabated but will be “turned off” when the appropriate level of free circulating



-Textbook of Medical Physiology,
SECOND EDITION, Indu Khurana,
MD, 2015, Elsevier

Feedback control of anterior pituitary secretion

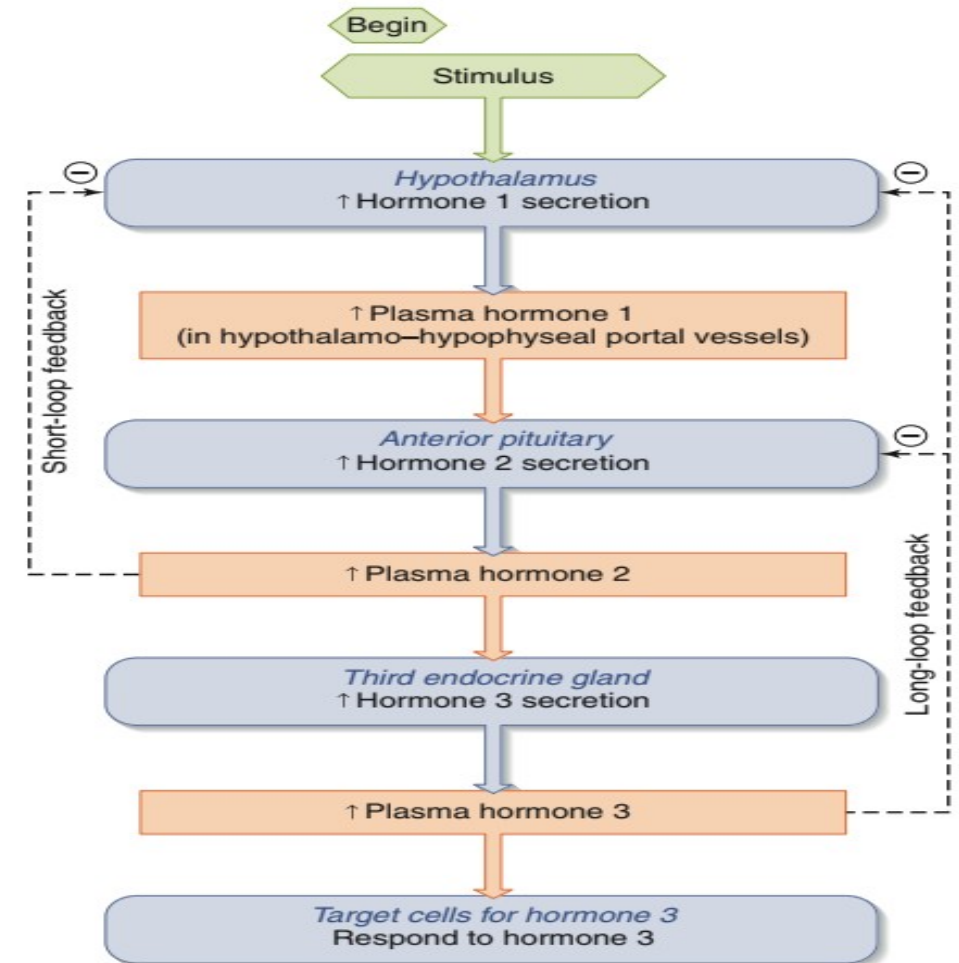


Long-loop negative feedback

the hormone secreted by the third endocrine gland in a sequence exerts -ve feedback effect over the anterior pituitary gland and/ or the hypothalamus

Short-loop negative feedback

Describe the influence of an anterior pituitary gland hormone on the hypothalamus



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Complete:

All anterior pituitary gland hormones are controlled by releasing hypothalamic hormones except for prolactin which is controlled by inhibiting dopamine which chemically is



Thyroid-stimulating hormone (TSH)



Synthesis and secretion

TSH-secreting **thyrotrope** cells constitute 5% of the anterior pituitary cells

Action:

TSH is the **physiologic regulator of T4 and T3 synthesis** and secretion by the thyroid gland. TSH also promotes nucleic acid and protein synthesis in the cells of the thyroid follicles, maintaining their size and functional integrity.

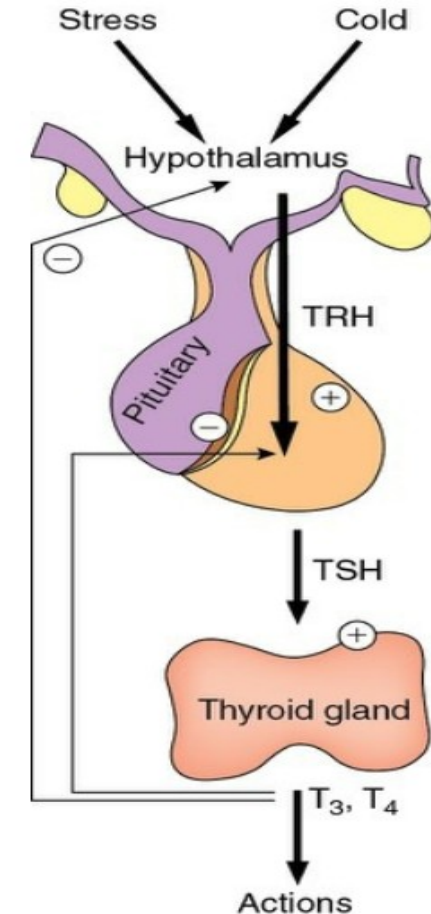
Thyroid-stimulating hormone (TSH)



Regulation:

TSH secretion is **stimulated** by **TRH**.

TSH is **suppressed** by **thyroid hormones** (-ve feedback) and somatostatin.



Textbook of Medical Physiology,
SECOND EDITION, Indu Khurana,
MD, 2015, Elsevier

Adrenocorticotrophic hormone (ACTH)



Synthesis and Secretion:

ACTH is synthesized by **corticotrope** cells which are about 20% of the pituitary cells.

ACTH is derived from precursor protein called Proopiomelanocortin (**POMC**) that also generates β -lipoprotein (its physiologic function in humans has not been established), β -endorphin, and α melanocyte-stimulating hormone (**α -MSH**).

ACTH contains the α -MSH amino acid sequence, so it has melanocyte-stimulating activity when present in the blood at high concentrations. As a result patients with **Addison disease** or an **ACTH-secreting tumor**, are often has **hyperpigmentation**.

Adrenocorticotrophic hormone (ACTH)



ACTH secretion is **pulsatile** and exhibits characteristic **circadian rhythm**, peaking t bout 6 am and reaching lowest level bout midnight. Adrenal glucocorticoid secretion, which is driven by ACTH, follows parallel diurnal pattern.

Action:

ACTH stimulate the synthesis and secretion of **glucocorticoids**, promotes the expression of the genes for various enzymes involved in steroidogenesis also also **maintains the size and functional integrity** of the cells of the **adrenal gland** (zona fasciculata and zona reticularis).

Adrenocorticotrophic hormone (ACTH)



Regulation:

The **predominant stimulator** of ACTH synthesis and release is **CRH**.

ACTH levels also **increased** by physical and psychological **stress**, exercise, acute illness, and insulin-induced hypoglycemia.

ACTH level **decreased** by -ve feedback inhibition by **high cortisol level**

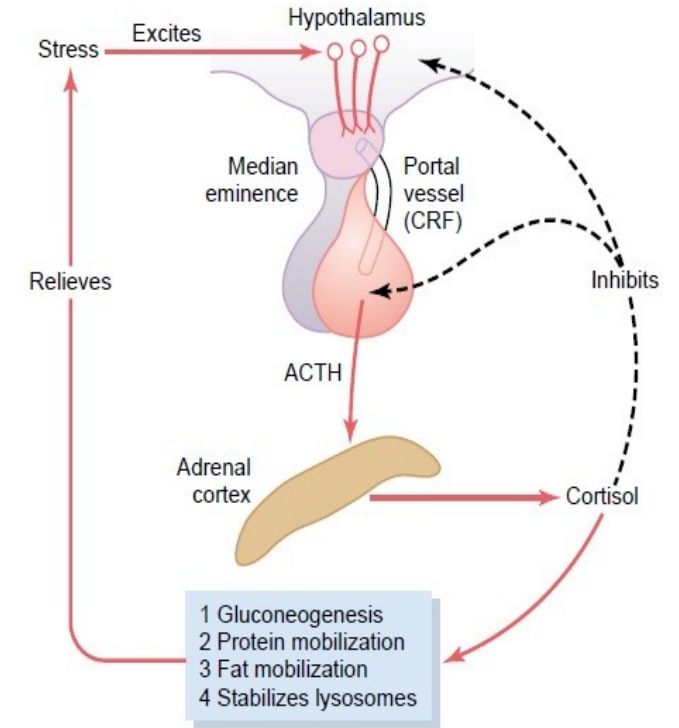


Figure 77-6

Mechanism for regulation of glucocorticoid secretion. ACTH, adrenocorticotrophic hormone; CRF, corticotropin-releasing factor.

https://www.brainkart.com/article/Regulation-of-Cortisol-Secretion-by-Adrenocorticotrophic-Hormone-from-the-Pituitary-Gland_20005/



Synthesis and secretion

Gonadotrope cells constitute about 10% anterior pituitary cells. They secrete 2 hormones LH and FSH. Its secretion is pulsatile.

Action:

In males:

FSH stimulates **spermatogenesis**

LH stimulates **testosterone secretion**

Gonadotropins



In females:

FSH stimulates early follicular development

LH stimulate final maturation of the ovarian follicle,
ovulation.

Secretion of estrogen and progesterone.

Regulation:

- Stimulated by GnRH
- Decreased by -ve feedback inhibition by high level of

testosterone, estrogen and progesterone.

Prolactin (PRL)



Synthesis and Secretion:

PRL is synthesized in **lactotropes**, which constitute about 20% of anterior pituitary cells.

Action:

- ✓ During pregnancy help in development of mammary gland.
- ✓ After labor, it initiates **lactogenesis** (milk formation) from the mammary gland that are primed by estrogen and progesterone.
- ✓ **Prevent ovulation and produce amenorrhea during**

Prolactin (PRL)



NB: Hyperprolactenemia in woman produce galactorrhea (increase milk secretion), amenorrhea (no menstrual cycles) and sterility.

✓ The function in male unsettled, but excess prolactin secreted by tumors causes **erectile dysfunction, hypogonadism and infertility.**

Prolactin (PRL)



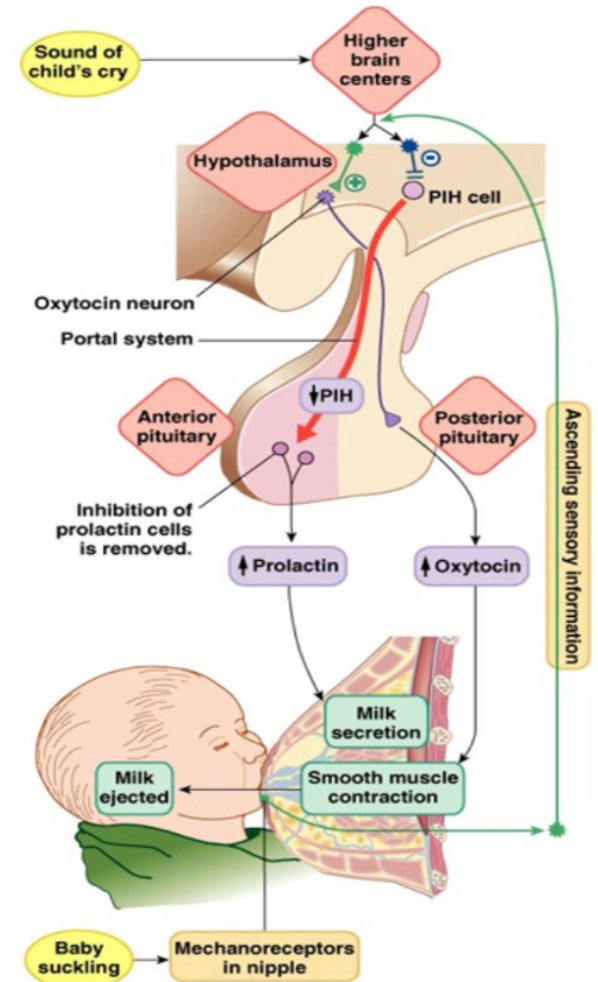
Regulation:

PRL is unique among the pituitary hormones in that the **predominant control is inhibitory** through **PIH (dopamine)**.

There is a -ve feedback control between prolactin and PIH

Stimulators:

- TRH, VIP (vasoactive intestinal peptide)
- After exercise, surgical procedures
- Psychological stress
- Stimulation of nipple (suckling reflex)



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Prolactin (PRL)



- Sleep (starting after onset of sleep and persist throughout the sleep period)
- Pregnancy (reaching peak at full term)

NB: After delivery, the plasma conc. falls to non-pregnant level, suckling increase its secretion again, but the magnitude gradually decline after nursing for more than 3 months.

- Dopamine receptor blockers

Inhibitors:

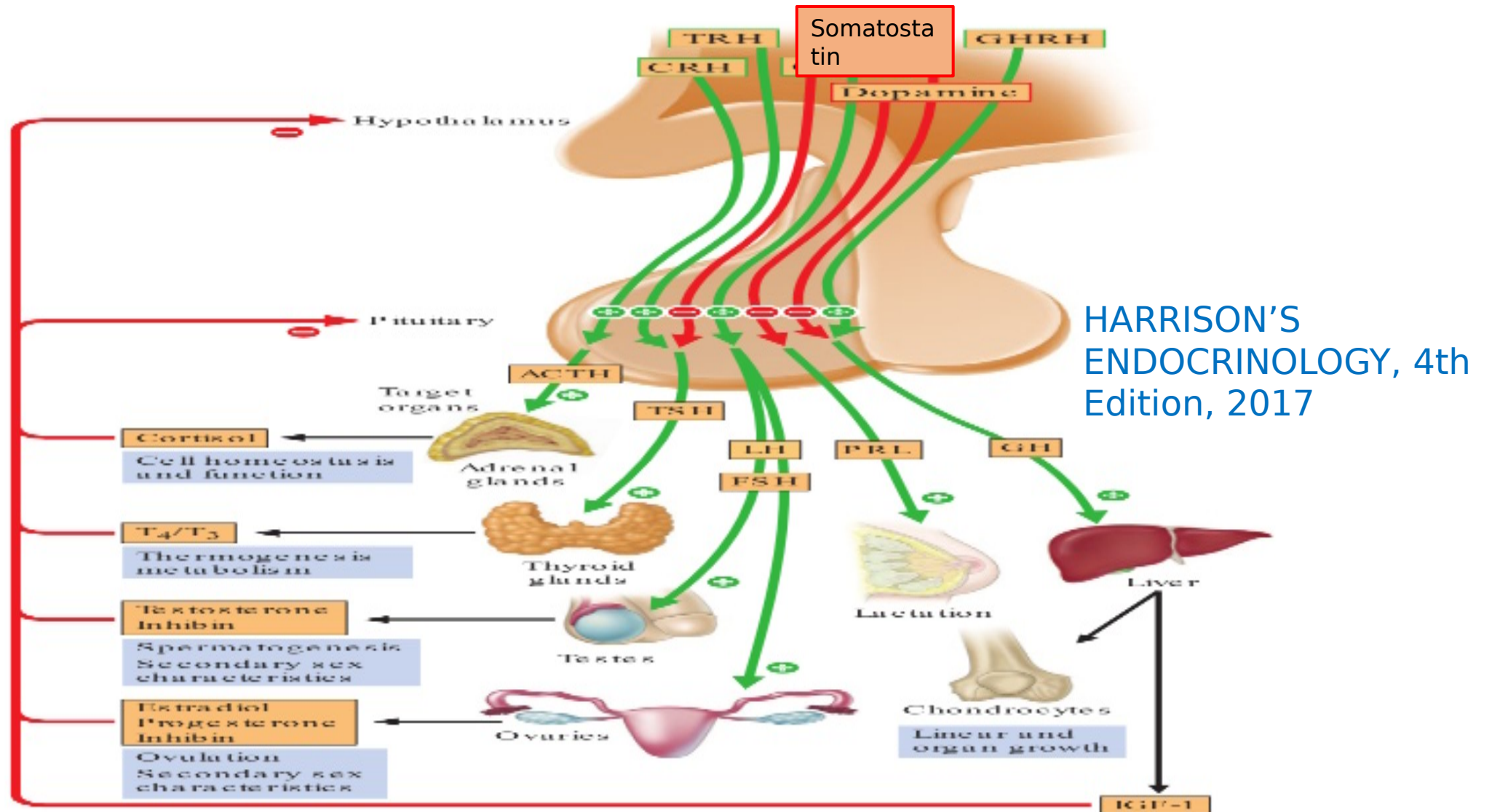
- L-dopa
- Dopamine agonist



Complete:

A hormone that has as its primary function the regulation of another endocrine gland is classified functionally as a **tropic hormone** like **TSH, ACTH, FSH & LH**, and

Summary





1- Which of the following is non tropic anterior pituitary hormone?

- A. Follicle-stimulating hormone (FSH).
- B. Luteinizing hormone (LH).
- C. Growth hormone (GH).
- D. Thyroid stimulating hormone (TSH).
- E. Adrenocorticotropic hormone (ACTH).



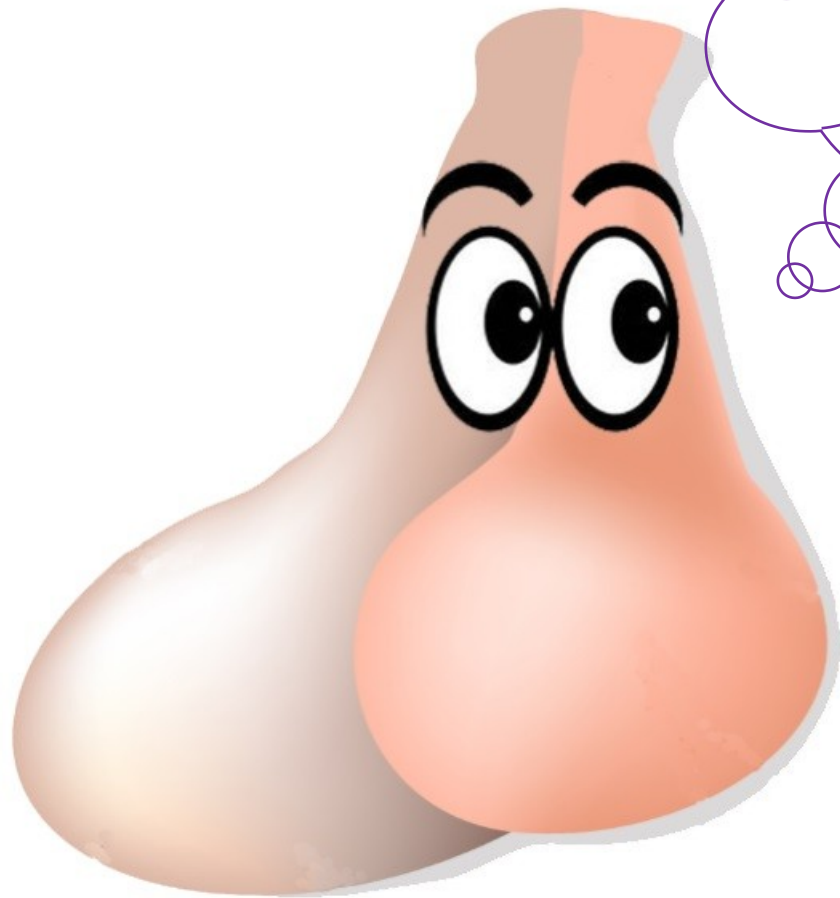
2- Which of the following inhibit the prolactin hormone?

- A. Stress.
- B. Sleep.
- C. TRH.
- D. VIP.
- E. L-dopa.

SUGGESTED TEXTBOOKS



1. Ganong's Review of Medical Physiology, twenty-fifth edition 2016, McGraw-Hill Education, chapter 17-18, from page 307 to 334
2. Guyton and Hall textbook of medical physiology, thirteenth edition 2016, Elsevier, chapter 76 , from page 939 to 950
3. Lauralee Sherwood Human Physiology: From Cells to Systems, Ninth edition 2016. CENGAGE, chapter 18, from page 646 to 652



***Thank
You***